ROCK-LEDGE VEGETATION IN SOUTHERN ILLINOIS

BY

GLEN SPELMAN WINTERRINGER

A.B., Illinois College, 1929
A.M., University of Illinois, 1930

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN BOTANY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1949

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ABSTRACT

This study is an investigation of rock-ledge vegetation in the Shawnee Hills of southern Illinois. It has been inspired by Professor A. G. Vestal's studies since 1930 of rock ledges at cliff-tops. Extensive field work has been carried on by the writer from 1947 to 1949. The study area lies along or near the main escarpment of Caseyville sandstone (lower Pennsylvanian) which crosses the state. Description includes (1) geography, (2) environmental complex, (3) vegetation-forming plant species, (4) correlation of these vegetation-forming species with habitats, (5) an annotated list of species of rock ledges and adjacent soil-borders, and (6) successional changes.

Extensive reconnoissance suggests that the somewhat uncommon topographic complex which provides bare shelves of rock at cliff-tops is nearly restricted to the main escarpment in the areas studied. Among the more notable cliff-top localities investigated, sixteen were studied more or less intensively.

As a result of field reconnoissance, and study of the literature of geography and geology of southern Illinois, a map has been prepared showing six geographic divisions or districts, as well as location of the sixteen study areas.

Climatic contrasts between the northern and southern parts of the state are notable. The hills of southern Illinois lie approximately within the same latitude as southern Virginia. Some influences of wind, rainfall, temperature and drought upon rock-ledge environment are described.

Soils of the western Shawnee Hills, as described in the soil report for Jackson county (Norton, Smith et al., 1933), are chiefly "eroded silt loam in Ava areas" except on rolling surfaces of upland ridges where they are "Ava silt loam, mature phase." The parent material of eroded silt loam is loess, except where sedentary soils have been exposed. Ledges near Mississippi River are few, because of deep loess cover.

The strata dip generally northward, with most of the cliffs facing southward. Limestone ledges are few and disturbed; hence, comparisons of different substrata are not possible.

An analysis of habitats of rock-ledges is included. Outer shelves of nearly bare rock are interrupted by crevices, recesses between rock layers, depressions, patches of thin soil, and seepways.

In places these rock shelves are nearly level; in other places there are gentle rock-slopes with rounded edges at the cliff-top. Width of ledges is from 2 to 6 feet, of convex rock-slopes 6 to 20 (or even 50) feet. Back of a nearly bare shelf is a "soil-border." The transitional strips between the rock surface and the usual soil-border receive extra supplies of run-off water from adjoining higher ground. Depending partly on direction of escarpment, partly on height of cliff, and on location of nearby trees, especially in talus below the smaller cliffs, the degree of exposure to wind and sun varies from a desert-like maximum to nearly full shade, with or without extra supplies of run-off.

Areas which surround the present rock ledges were originally well forested, but culling of timber, clear cutting for charcoal, and recurrent fires have done much to alter the original plant cover. The southern Shawnee district is in large part cultivated, although its rougher parts are still forested. Representative lists of plants of cut-over woods, barrens and prairies are included. A conspectus of the principal vegetation-forming species is arranged according to the growth-forms of the plants.

A correlation of habitats and synusiae is presented in detailed form for each of the specialized environments, and includes those plants or groups of plants notable or characteristic there. Many species occur in a number of different situations, but in different degrees of frequence or density, and in different forms or statures.

The vegetation studied is a discontinuous complex of non-extensive elements, mostly of single species. Therefore the familiar ecological methods of evaluating relative importance of species are hardly applicable. Modifications of methods (devised by Professor A. G. Vestal) permit use of different criteria for judging abundance. Some of the terms and symbols used for abundance and frequence-classes are new.

Vegetation maps for seven localities, ranging from Draper Bluff towards the west, to Cave Hill, in the northeastern part of Shawnee Hills, are included. Each of these areas is shown as a grid of 0.25-milacre plots, each 3.3 feet on a side. Species of non-vascular and vascular plants are indicated by appropriate symbols. A table shows abundance and frequence for 161 species of plants observed on rock ledges or in neighboring soil-borders in each of the 16 localities studied. "Percentage of presence" is shown in a separate

column. Only 4 or 5 species occur in as few as 3 localities. In 11 or more localities 42 species occur. Five species were found in all 16 localities.

Successions on three types of surface are so different that separate descriptions are needed: (1) Originally bare rock with full exposure but not receiving extra run-off or deposition of silt partly covered, apparently permanently, by a common and widely distributed lichen, *Parmelia conspersa,* and by two other lichens and two mosses. (2) On rock-ledge surfaces which vary from the above condition many different plants form partial or local cover, according to amount of moisture and soil available, with usually only one or a few species in any microhabitat. Recurrent extremes of severe drought or of erosive wash destroy or seriously reduce almost all the patchy growths, few surviving, so far as limited observations indicate, more than three or four years in any one spot. Destructive forces prevail over the constructive reactions of plants. (3) Soil borders of varying character in different exposures and with different supplies of run-off are mostly in a "steady state," a balance between destructive, especially erosive forces, and constructive tendencies. Where the latter prevail, at least for a time, soil borders widen, and the bare rock shelf next to the cliff-edge is narrowed, and in places entirely covered. The soil border thus represents at least a temporary climax in the succession. This successful vegetation-development is the usual result on those cliff-tops which are not too severely exposed. This is also one reason for the relatively small number of localities showing extensive development of bare ledges or rock-slopes. (Other reasons are physiographic.)

Through recurrent drought or erosion, ledges and bare-rock slopes are re-initiated under certain circumstances where sizable blocks fall away from cliff-tops. The problem of elimination of bare-rock surfaces at cliff-tops belongs to the field of geomorphology rather than to plant succession.

The annotated list of 161 species includes non-vascular as well as vascular plants. Collection numbers are given, and the cited specimens have been deposited in the University of Illinois herbarium.

The plant species of southern Illinois cliff-tops and neighboring uplands and ravines are a limited but highly diversified selection from floras of southeastern United States, with a few stray species

from originally western and southwestern sources. Plants more common on cliff-tops than elsewhere in southern Illinois are *Vaccinium arboreum* (farkleberry), *Sedum pulchellum* (an annual white-flowered stonecrop), *Opuntia rafinesquii* (prickly pear), *Talinum parviflorum* (a succulent perennial), *Parmelia conspersa, Hedwigia ciliata* (a creeping or later erect moss), *Grimmia olneyi* and perhaps *Grimmia apocarpa* (both are dark, cushion-forming mosses common on exposed rock.) These are typical plants of rock ledges.

VITA

Glen Spelman Winterringer was born October 6, 1906, at Arcola, Illinois, the son of John and Martha Winterringer. He received both primary and secondary education in the Arcola public schools; graduating from the Arcola Township High School in May 1925.

He received his A.B. degree in biology from Illinois College in June 1929, having served as undergraduate assistant in botany since September 1927. In September 1929 he entered the Graduate School of the University of Illinois. He received his A.M. degree in botany in June 1930. He taught biology and general science in secondary schools for eleven years, at Crystal Lake, Illinois; Whiting, Indiana, and Petersburg, Illinois.

He enlisted in the United States Army in August 1942, and served in both Ground Forces and the Air Force until October 1945, when he received an honorable discharge. He returned to the University of Illinois in March 1946, an dserved as graduate research assistant in systematic botany for two years. He is a member of Sigma Xi, Phi Sigma, and Phi Delta Kappa, as well as the Botanical Society of America, the Ecological Society of America, and the American Society of Plant Taxonomists. He is author of: *The Acanthaceae of Illinois,* Trans. Ill. Acad. Sci. 40: 73-78, 1947, and *Salicornia europaea in Illinois,* Rhodora 51: 11-12, 1949.

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